Problems

22.P.10) $d\sin\theta_m = m\lambda$

$\sin\theta_M = \dfrac{m\lambda}{d}$

$\sin 60 = \dfrac{\lambda}{d}$

$\dfrac{1}{\sin 60} = \dfrac{d}{\lambda}$

$d = \dfrac{\lambda}{\sin 60}$

$\sin\theta = \dfrac{2\lambda}{\dfrac{\lambda}{\sin 20}}$

$\sin\theta = 2\sin 20$

$\dfrac{2\lambda}{\dfrac{1}{\dfrac{\lambda}{\sin 20}}}$

$\dfrac{2\sin 20 \cdot \lambda}{\lambda} = 2\sin 20$

$\theta = \sin^{-1}(2\sin 20)$

$\theta = 43.16°$

$\theta = 43.1°$

22.P.12

$\lambda = 656 \times 10^{-9} m$
$\lambda = 486 \times 10^{-9} m$
$L = 1.5 m$
$y_m = 5.0 \times 10^5 L/m$

$y_m = 0.521 m$
$y_m = 0.376 m$

$d = 14.5 cm$

$y_m = L\tan\theta$
$d\sin\theta = m\lambda$

$d_{slit} = 1/N$
$d = 2.0 \times 10^{-6} m$

$\sin\theta = \dfrac{m\lambda}{d}$

$\theta = \sin^{-}\left(\dfrac{m\lambda}{d}\right)$ $m = 1$
$\lambda = 656 nm$
$d = 2.0 \times 10^{-6} m$

$\theta = 19.14°$

$y_m = (1.5m)\tan(19.14)$
$y_m = 0.521 m$

$\sin\theta = \left(\dfrac{m\lambda}{d}\right)$

$\theta = \sin^{-1}\left(\dfrac{m\lambda}{d}\right)$
$m = 1$
$\lambda = 486 nm$
$d = 2 nm$
$\theta = 14.06°$

$y_m = (1.5m)\tan(14.06°)$
$y_m = 0.376 m$

22.P.14) $m = 3$ $\lambda = 660 \times 10^{-9}\,m$ $y_m = L \tan \sigma$ $\mathcal{R} = \Delta x$
         $m = 5$ $\lambda = ?$ $d \sin \sigma = m\lambda$

                              $d =$ in both scenarios

         $\sin \sigma_m = 3\lambda_1$ $3\lambda_1 = 5\lambda_2$
         $\sin \sigma_m = 5\lambda_2$

                                        $\lambda_2 = \dfrac{3\lambda_1}{5} = \dfrac{3(660 \times 10^{-9}\,m)}{5} = 396\,nm$

                    $\boxed{\lambda = 396\,nm}$

Conceptual

22.CQ.2) $\Delta y = \dfrac{m \lambda L}{d}$

a.) Increases Δy
b.) Decreases Δy
c.) Increases Δy
d.) This would cause a different index of refraction, Δy would decrease